Tutorial 3: Screening

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Components of Validity

TABLE 3–A

Screening test result by diagnosis

Screening test results	Diagnosis		Total
	Diseased	Not diseased	
Positive	a (True-positive)	b (False-positive)	a+b
Negative	c (False-negative)	d (True-negative)	c + d
Total	a + c	b + d	a + b + c + d

Sensitivity

(a) Sensitivity = a/ (a + c) × 100

- The ability of the test to identify correctly all those who have the disease, that is "**true-positive**".
- 90% sensitivity means that 90% of the diseased people screened by the test will give a "**true-positive**" result and the remaining 10% a "false-negative" result.

Specificity

(b) Specificity = d/(b + d) × 100

- The ability of a test to identify correctly those who do not have the disease, that is "**true-negatives**"
- 90% specificity means 90% of non-diseased persons will give "**true-negative**" result, 10% of non-diseased people screened by the test will be wrongly classified as "diseased" when they are not "false-positive".

Diagnosis of brain tumours by EEG

EEG results	Brain tumour	
	Present	Absent
Positive	36	54,000
Negative	4	306,000
	40	360,000

Sensitivity = 36/40 × 100 = 90 per cent
Specificity = 306,000/360,000 × 100 = 85 per cent

Diagnosis of brain tumours by computer assisted axial tomography

CAT results	Brain tumour	
	Present	Absent
Positive	39	18,000
Negative	1	342,000
	40	360,000

Sensitivity = 39/40 × 100 = 97.5 per cent
Specificity = 342,000/360,000 × 100 = 95 per cent

Cont'

Predictive accuracy

- Reflects the diagnostic power of a test.
- Depends upon sensitivity, specify and disease prevalence
- The probability that a patient with a positive test result has, in fact, the disease in question.
- The more prevalent is a disease in a given population, the more accurate will be the predictive value of a positive screening test.

(c) Predictive value of a positive test = a/(a + b) x 100

(d) Predictive value of a negative test = d/(c + d) x 100

(e) Percentage of false-negatives = c/(a + c) x 100

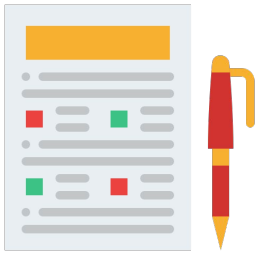
(f) Percentage of false-positive = b/(b + d) x 100

Predictive value of a positive gram-stained cervical smear test
(with constant sensitivity of 50% and specificity of 90%) at three levels of prevalence

Prevalence 5%				Prevalence 15%				Prevalence 25%			
	Culture				Culture				Culture		
	+	−	Total		+	−	Total		+	−	Total
Smear	+ 25	95	120	Smear	+ 75	85	160	Smear	+ 125	75	200
	− 25	855	880		− 75	765	840		− 125	675	800
Total	50	950	1000	Total	150	850	1000	Total	250	750	1000
Positive predictive value	$\frac{25}{120} \times \frac{100}{1} = 21\%$			Positive predictive value	$\frac{75}{160} \times \frac{100}{1} = 47\%$			Positive predictive value	$\frac{125}{200} \times \frac{100}{1} = 63\%$		

- In the exam you might be given the formula and asked to give the interpretation or vice versa, you might be given the interpretation and asked for the formula. e.g: 90% of the diseased people screened by the test will give a "true-positive" result and the remaining 10% a "false-negative" result what is the formula?. answer: this is sensitivity and the formula is
a/(a+c)×100.

Questions and answers



Exercise 1:
In a survey, 100 persons were positive to the reference test for disease A and 900 were negative. The screening test identified 200 persons to be positive. Of these 80 were positive to the reference test.

		Diagnostic test		
		Disease	Non Disease	Total
Screening test	+ve	80	120	200
	-ve	20	780	800
	Total	100	900	1000

(a) Sensitivity = a/ (a + c) × 100

= 80/100 X 100 = 80%

(b) Specificity = d/(b + d) × 100

=780/900 X 100 = 86.7%

(c) Predictive value of a positive test = a/(a + b) × 100

= 80/200 X 100 = 40% **who tested +ve actually they have the disease**

(d) Predictive value of a negative test = d/(c + d) × 100

= 780/800 X 100 = 97.5% **who tested -ve actually don't have the disease**

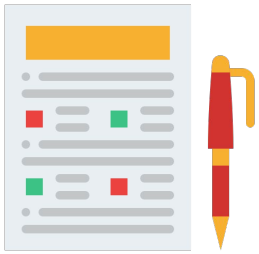
(e) Percentage of false-negatives = c/(a + c) × 100

= 20/100 X 100 = 20%

(f) Percentage of false-positive = b/(b + d) × 100

= 120/900 X 100 = 13.3%

Questions and answers



Exercise 2:

A new non invasive test has been developed to diagnose breast cancer. Of 1000 patients; 50% were diagnosed positive. Of those who tested positive, a Biopsy test yielded 475 with positive results. Of those who tested negative; 50 patients were actually Cancer breast positive when tested against the Biopsy.

		Diagnostic test		
		+ve breast cancer	-ve breast cancer	Total
Screening test	+ve	475	25	500
	-ve	50	450	500
	Total	525	475	1000

(a) Sensitivity = a/ (a + c) × 100

= 90.5%

➔ Among those who are diseased, 90.5% will be positive with the new test

(b) Specificity = d/(b + d) × 100

= 94.7%

➔ Among those who doesn't have the disease, 94.7% will show true negative

(c) Predictive value of a positive test = a/(a + b) × 100

= 95%

➔ Among those who tested positive, 95% are actually have the disease

(d) Predictive value of a negative test = d/(c + d) × 100

= 90%

➔ Among those who tested negative, 90% will not have the disease

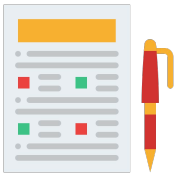
(e) Percentage of false-negatives = c/(a + c) × 100

= 9.5%

(f) Percentage of false-positive = b/(b + d) × 100

= 5.2%

Questions and answers



Exercise 3:

Match the following sentences with the appropriate term:

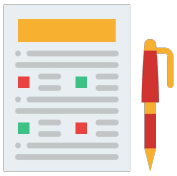
I. The ability of a test to correctly identify those who have a disease (**sensitivity**)

II. The proportion of those without the disease correctly identified as negative by screening test (**Specificity**)

III. Ability of the test to detect true negative cases (**Specificity**)

IV. Probability of disease in patients with positive test result (**PP+ve**)

V. Probability of not having the disease in a subject with negative test result (**PP-ve**)



Exercise 4:

300 known diabetics (positive on the glucose tolerance test) and 250 normal volunteers (negative on the glucose tolerance test) are given finger prick tests, the results are:

		Glucose tolerance test		
		+ve	-ve	Total
Finger Prick	+ve	282	20	302
	-ve	18	230	248
	Total	300	250	550

Sensitivity of the test is:
a) 20% b) 90%
c) 94% d) 98%

Specificity of the test is:
a) 90% b) 92%
c) 94% d) 98%

The capacity of a test or procedure to screen as "**negative**" those NOT having a specific disease is:

a) sensitivity b) positive predictive value
c) specificity d) negative predictive value

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